SUBSTITUTE SPECIFICATION

Title of the Invention

STEERING DEVICE FOR SPORTS ARTICLES PROVIDED WITH SUPPORTING AND SLIDING ELEMENTS IN AN IN-LINE ARRANGEMENT

Background of the Invention

The present invention refers to a steering device for sports articles adapted to slide on a supporting surface by means of a plurality of supporting and sliding elements provided in an in-line arrangement, i.e. aligned along a same longitudinal axis. These sports articles, which may for instance be constituted by in-line roller skates, ski-rolls, scooters, sledges, ski-scooters and the like, are intended for sliding either on the ground by rolling thereupon, or on a snow blanket or ice by gliding thereupon.

An important requirement that such sports articles are supposed to meet is the leading and running precision that they must ensure when re-directing the course, i.e. when the skating or sliding direction is being changed. This is particularly true in connection with such sports activities as for instance street or ice hockey or figure skating, which involve continuous and abrupt changes of the sliding course. The possibility of performing continuous turns with a curving radius as small as possible is therefore a problem that is particularly felt when using these articles, with particular reference to in-line roller skates and ice skates.

The technical solution disclosed in US 2,204,280, filed with a claimed Swiss priority of August 17, 1937, is aimed at solving – at least partially – the above-indicated technical problem. This patent refers in fact to a skate with two in-line wheels, each one of which is supported by a respective fork that is pivotally connected – in correspondence to a lower portion thereof and outside of the vertical plane passing through the axis of the wheels – to a

support member provided in an inclined arrangement relative to the chassis, so as to enable the same fork to swing transversally against the action of elastic elements. The pivoting centers of the two forks are situated on opposite sides and externally with respect to the axes of the respective wheels, so that these wheels, which are aligned with each other when running along a rectilinear course, are caused to automatically deflect into an oblique position when a curving action is being performed.

A major drawback of this prior-art approach lies in the poor stability of the skate, as well as in the difficulty that is encountered when trying to obtain a continuous, smooth curving effect owing to the distance existing from the front wheel to the rear wheel. As a matter of fact, although both of them are actually provided with a steering device of their own, the two wheels are situated too far from each other to be able to arrange themselves according to such an ideal arc of curvature as to enable the skater to curve in a smooth, continuous manner. As a result, the skater is forced to intervene with a number of progressive adjustments of the trajectory so as to be able to move over the entire curve, which is therefore performed and completed in a discontinuous manner. In addition, owing again to the distance between the wheels, when performing a curving manoeuvre the forks may be subject to vibrations due to the quite significant stresses acting upon each wheel, and these vibrations may bring about a substantial instability of the skate, with a resulting difficulty being found in leading and running the skate with the due accuracy exactly during such a critical phase as the one implying a curve, i.e. a change of direction.

A further drawback lies in the fact that the steering device of the above-cited prior-art solution is only capable of working in connection with wheels having a flat tread. In fact, it is by inclining the chassis sideways that a change of direction is obtained, thereby determining a reaction of the

supporting surface on the wheels, which eventually relieves itself onto the pins that pivotally connect the forks to the support members, thereby causing the forks themselves to rotate relative to the corresponding support members.

Objects of the Invention

It therefore is a main object of the present invention to overcome the above-cited drawbacks of prior-art solutions by providing a steering device for sports articles adapted to slide on a supporting surface by means of a plurality of supporting and sliding members provided in an in-line arrangement, which is reliable and safe in use.

Within the above general object, a purpose of the present invention is to provide a steering device which enables a change of direction, i.e. a curve, to be performed in a smooth and continuous manner while maintaining full stability and control of the article throughout the period in which said manoeuvre is being performed.

Another purpose of the present invention is to provide a steering device which is capable of working in an optimum manner even in currently marketed sports articles, without any limitation whatsoever as far as the number and the characteristics and features of the supporting and sliding members thereof are concerned. In particular, the steering device of the invention must be capable of working in an optimum manner in those articles that are provided with wheels as supporting and sliding members having a curved tread thereof, such as for instance in-line roller skates and scooters.

A further, equally important purpose of the present invention is to provide a steering device at competitive costs, which is in addition capable of being

manufactured with the use of existing techniques and equipment.

According to the present invention, these object and purposes, as well as further purposes that will be apparent in the following description, are reached in a steering device for sports articles adapted to slide on a supporting surface by means of a plurality of supporting and sliding elements provided in an in-line arrangement, i.e. aligned along a same longitudinal axis.

Brief Description of the Drawings

Features and advantages of the steering device according to the present invention will be more readily understood from the description of a particular, although not sole, embodiment that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a side elevational, partially cross-sectional view of a steering device according to the present invention, as applied to an in-line roller-skate;

- Figure 2 is an exploded view, similar to the one appearing in Figure 1, of the steering device according to the present invention.

- Figure 3 is a cross-sectional view of the steering device illustrated in Figure 1 as viewed along sectional plane III-III;

- Figure 4 is an exploded view of the cross-sectional representation of Figure 3;

- Figure 5 is a bottom plan view of the roller skate illustrated in Figure 1 in a first operating position thereof;

- Figure 6 is a bottom plan view of the roller skate illustrated in Figure 1 in a second operating position thereof.

- Figure 7 shows a second embodiment of a steering device according to the present invention;

- Figure 8 shows a third embodiment of a steering device according to the present invention;

- Figure 9 shows a fourth embodiment of a steering device according to the present invention;

- Figure 10 shows a fifth embodiment of a steering device according to the present invention;

- Figure 10a shows a particular of the steering device of Figure 10;

- Figure 11 is a bottom plan view of the wheel arrangement for the steering device of Figure 10.

Detailed Description of the Preferred Embodiments

With reference to the above-listed Figures, reference numeral 1 is used there to generally indicate a sports article adapted to slide on a supporting surface 2 by means of a plurality of supporting and sliding or rolling elements 3 aligned along a same longitudinal axis 4 or, in other words, provided in an in-line arrangement. In the particular embodiment illustrated in the Figures, the sports article is constituted by a skate 1 provided with at least three, and preferably four, wheels 3 that perform as the elements on which the skate is capable of supporting and rolling on a supporting surface

formed by the ground 2; the wheels 3 are provided in an in-line arrangement and have a curved tread.

The skate 1 comprises a chassis 5 supporting in a known manner a footwear (not shown) provided thereupon, wherein at least a carriage 6a provided to support at least a pair of wheels 3 is associated to the chassis. This carriage 6a is associated to the chassis 5 in a manner as to be able to swing about an axis 7 inclined at an angle α relative to the ground 2 and lying substantially on the longitudinal median plane of the chassis as defined by the longitudinal axis 4.

With reference to the particular embodiment illustrated in the accompanying Figures, the chassis 5 has, approximately in correspondence to at least an end portion 8a thereof, a support member 9 provided with a first through-hole 10 and having at least a surface 9a inclined relative to the ground 2 by an angle β, which is preferably complementary to the angle α.

The carriage 6a has an arm 11 for the connection thereof to the support member 9, the arm being provided with a second through-hole 12 and having a surface 11a facing towards and counter-shaped, i.e. shaped complementarily, to the surface 9a. From this arm 11 there extend, on respective, mutually opposite sides, a first and a second fork 13, 14, each one of which pivotally supports a wheel 3 in correspondence to respective support axes 25, 26.

Extending through the first hole 10 and the second hole 12 there are connecting means, such as a threaded pin 15 or the like, for pivotally connecting the carriage 6a to the support member 9; the pin 15 is locked with the aid of appropriate locking means, such as a lock-nut or bolt 16.

The configuration of the carriage 6a and the support member 9, along with the arrangement of the related connection, is such as to ensure that the supporting and sliding elements, i.e. the two wheels 3 in this case, are supported by the carriage 6a in a manner that is substantially parallel to the supporting surface 2, which is formed by the ground in this case, on opposite sides with respect to the pivoting center 27 of the carriage 6a relative to the chassis 5, as defined by the pin 15 and the second hole 12.

Appropriate elastic structure or means 17, 18 interacting with the arm 11 are provided to elastically contrast the swinging motion of the carriage 6a with respect to the chassis 5. According to a preferred embodiment illustrated in Figures 3 and 4, the above-cited elastic means 17, 18 are housed within respective accommodations 19, 20 provided in the support member 9; they are further provided with respective apertures 21, 22 for the insertion therethrough of respective projections 23, 24 extending from the arm 11. In this manner, the accommodation of these elastic contrasting means 17, 18 turns out as being extremely compact and fully contained within the carriage 6a. In an advantageous manner, the degree of elasticity of the elastic means 17, 18 may be varied with the help of appropriate adjustment means or by simply replacing the elastic means 17, 18 with other means having a different elasticity rating as required.

The swinging axis 7 preferably extends approximately in correspondence to or above the support axis 25 of the supporting and sliding element 3 situated in the neighbourhood of the middle portion of the chassis 5.

The description given above refers to a steering device comprising a single carriage 6a. However, a preferred embodiment of the device, as illustrated in Figures 1, 5 and 6, calls for the utilization of two carriages 6a, 6b provided in an arrangement in which they symmetrically oppose each other,

approximately in correspondence to the end portions 8a, 8b of the chassis 5, wherein each such carriage supports a pair of wheels 3.

The operation of the device is as follows: from the position that is held when the article, i.e. the skate in this case, follows a rectilinear path, in which the supporting and sliding elements are arranged aligned along the longitudinal axis 4 (Figure 5), a change in direction is obtained by the effect of a sidewise inclination that the user imparts to the article; this motion causes the carriages 6a, 6b to rotate with respect to the chassis 5 in opposite directions about the swinging axis 7 against the action of the elastic means 17, 18, as this is best shown in Figure 6. In this manner, the supporting and sliding elements 3 are able to arrange themselves along two incident axes that can be assimilated to an arc of a circle owing to the contiguousness of the same supporting and sliding elements 3. Such an arrangement makes it possible for the change in direction to be performed in a smooth and continuous manner, thereby enabling the user to maintain the stability and the control of the article throughout the phase during which such manoeuvre, i.e. the change in direction, is being performed.

Fully apparent from the above description is therefore the ability of the in-line roller-skate according to the present invention to effectively reach the afore cited aims and advantages: in fact, the steering device according to the present invention is reliable and safe in use, while enabling the user to perform even sudden, abrupt changes of direction in a smooth and continuous manner and maintaining full stability and control of the article throughout the phase during which such manoeuvre, i.e. the change in direction, is being performed. These advantages are obtained by the user through a simple inclination of the article in the direction in which he/she wishes to turn: this in fact brings about such an interplay of forces on the carriages 6a, 6b as to cause them to rotate, i.e. swing in a mutually opposite

manner about the axis 7 against the action of the elastic means 17, 18: the front carriage 6a rotates in the direction of curvature, while the rear carriage 6b rotates in the opposite direction, in such a manner as to approximately define an arc of a circle, as shown in Figure 6, which substantially corresponds to the arc of the curve that must be performed. Furthermore, the conformation of the wheels 3 provided with a curved tread 28, which allows the article to incline, i.e. to move into its inclined posture as required in view of enabling the steering device according to the present invention to properly operate, allows for the same steering device to be used practically on all sports articles that are currently marketed with the afore-indicated features.

It shall be appreciated that the above-described steering device may of course be the subject of a number of modifications and variants, also in connection with different applications, without departing from the scope of the present invention.

For example, the embodiments shown in Figures 7, 8 and 9 refer to a steering device as described above applied to a sports article, such as a roller skate 101, 201, 301, having a plurality of supporting and sliding elements, such as wheels 103, 203, 303, of different size. Hereinafter the description shall refer to a steering device according to the present invention as applied to an in-line roller skate, but it is understood that the steering device can be evenly applied to any sports article having a plurality of supporting and sliding elements of a different size arranged along a line.

More in detail, Figure 7 shows an arrangement for the supporting and sliding elements comprising four wheels 103 wherein the front wheel 103a and the third wheel 103c are smaller in diameter than the second wheel 103b and the rear wheel 103d; the wheels 103a and 103b are supported on

respective first support axes 125a and 126a by a first carriage 106a which is associated to a chassis 105 in a manner as to be able to swing about a first axis 107a as already described above; similarly, the wheels 103c and 103d are supported on respective second support axes 125b and 126b by a second carriage 106b associated to the chassis 105 so as to be able to swing about a second axis 107b having an inclination in respect to a supporting surface 102 which is opposite to the inclination of the first axis 107a. In order to allow the wheels 103a and 103b, as well as the wheels 103c and 103d, to contact the supporting surface 102 along the same plane, the line 130a connecting the first support axis 125a and 126a is slightly inclined in respect to the supporting surface 102; due to the particular wheel arrangement of this embodiment, the line 130b connecting the second support axis 125b and 126b is inclined along the same direction of line 130a. This specific wheel arrangement achieves an increase in the acceleration of the skate, especially when starting, thanks to the provision of the smaller front wheel 103a which rotates at a higher rotational speed and it has a lower inertia.

The third embodiment shown in Figure 8 refers to a different arrangement for the wheels, wherein the central wheels 203b and 203c are smaller in diameter that the front wheel 203a and the rear wheel 203d; in this case, lines 230a and 230b connecting, respectively, first support axes 225a, 226a and second support axes 225b, 226b are oppositely inclined in respect to the supporting surface 202 in order to allow all the wheels to contact the supporting surface 202 along the same plane. This arrangement provides the skater with a more stable balance: in fact, the center of balance, which is determined by the height of the ball of the foot in respect to the ground, can be lowered since the smaller second wheel 203b located under the ball of the foot allows lowering of the height of the chassis 205, and in particular the height of the sole plate which supports the sole of the footwear, thus getting the foot closer to the ground.

Figure 9 shows a further arrangement for the wheels 303, providing front wheels 303a and 303b of a smaller diameter than rear wheels 303c and 303d; with this arrangement the lines 330a and 330b connecting, respectively, first support axes 325a, 326a of the front wheels 303a, 303b, and second support axes 325b, 326b of the rear wheels 303c, 303d, are arranged parallel to the supporting surface 302 but mutually located at different heights in respect to the supporting surface 302. This wheel arrangement enhances the characteristics of acceleration of the skate, thanks to the provision of the smaller wheel 303a at the front of the skate as explained above, as well as of stability thanks to the second smaller wheel 303b located under the ball of the foot which allows lowering of the center of balance of the skater; in addition, the larger wheels 303c and 303d at the rear have an influence on the efficiency of the skate, allowing the skater to maintain the speed acquired through the higher acceleration at a substantially constant value with a relative low power supply from the skater.

A further embodiment is shown in Figures 10 to 11, wherein a skate 401 comprises a first carriage 406a and a second carriage 406b each supporting at least a pair of wheels 403; the first carriage 406a and the second carriage 406b are associated to a chassis 405 approximately in correspondence of its end portions 408a, 408b, in a manner as to be able to swing about respective axis 407a and 407b arranged at an angle of 90° relative to the ground 402 and lying substantially on the longitudinal median plane of the chassis 405 as defined by the longitudinal axis 404.

With reference to Figure 10a, the following description refers to the second carriage 406b, however it evenly applies to the first carriage 406a. The second carriage 406b has an arm 411 provided with a through-hole 412 for

connection to the chassis 405, this latter being provided with a corresponding through-hole 410; connecting means, such as a threaded pin 415 or the like, extends through the holes 410 and 412 for pivotally connecting the carriage 406b to the chassis 405; the pin 415 is locked with the aid of appropriate locking means, such as a lock-nut or bolt 416.

From the arms 411 there extend, on respective, mutually opposite sides, first and second forks 413, 414 pivotally supporting the wheels 403 in correspondence to respective support axes 425, 426.

The wheels 403 have a different size: in fact the wheels 403a arranged at the front and at the rear of the skate 401 have a width which is smaller than that of the wheels 403b arranged in a central portion of the chassis 405.

Appropriate elastic means 417 interacting with the arms 411 are provided to elastically contrast the swinging motion of the first carriage 406a and of the second carriage 406b in respect to the chassis 5.

The wheel arrangement of Figures 10 to 11 allows achievement of a change of direction thanks to the larger width of the central wheels 403b: in fact, when the skater inclines the skate laterally toward the ground, the larger central wheels 403b remain the only wheels in contact with the ground, thus forcing the swingable carriages 406a and 406b to swing about the vertical axis 407a and 407b along opposite directions so that an ideal line of curvature is achieved.

It is understood that the materials used to manufacture the device of the present invention, as well as the shapes and the sizing thereof, may each time be selected so as to more appropriately meet the particular requirements or suit the particular application, without departing from the

scope of the present invention.